XRD9827REF
USER MANUAL

CANNON CIS 36-BIT COLOR
SINGLE LINE SCANNER

PRELIMINARY
EVALUATION KIT PART LIST

This kit contains the following:
- XRD9827REF CIS 36-Bit Color Single Line Scanner
- XRD9827REF User Manual
- SenseIt 1.0 Software Installation Diskettes (2)
- XRD9827 Data Sheet
- Scan Targets (Black, White, Color)

FEATURES

- One line scanning functionality of XRD9827 with CANON 600DPI CIS (Contact Image Sensor)
- Easy to use with most personal computers through Parallel Port Interface
- Simple way of loading the Serial Port of XRD9827 to adjust gain and offset
- Software SenseIt 1.0 to view single line scan
- Optimized PCB Layout with Four Layer

SYSTEM REQUIREMENTS

- Intel 486 compatible computer with Windows 95 operating system
- 8 MBytes system memory
- 25-pin D-shape parallel port receptacles
- 3 1/2" floppy disk drive

INTRODUCTION

The XRD9827REF is a demo system which includes a PCB design with a CANON CVA-60216K 600DPI Color Contact Image Sensor (CIS). It demonstrates how to interface a CIS with EXAR's XRD9827, a 12-bit Linear CIS/CCD Sensor Signal Processor to output a single line scan and display the amplitude of each of the three colors. The XRD9827REF is designed to provide a signal path for the CIS output signals to be processed, digitized by the XRD9827 and transmitted to a personal computer. There are no software algorithms or hardware implementations, for example, gamma correction, to adjust for color response.

The XRD9827REF board is loaded with the XRD9827, a Vantis MACH435 CPLD, two FIFO SRAMs and peripheral circuits for the CIS. The MACH435, which is a CMOS Programmable Logic Device (CPLD) provides timing signals to the XRD9827, the SRAMs and the CIS. It also programs the XRD9827 to operate in the correct mode and adjust for gain and offset values. The XRD9827 processes the analog output from the CIS sensor, level-shifts and converts the signal into 12-bit digital codes. The SRAMs gate the digitized data from the XRD9827 and stores the data temporarily. Controlled by the software, the SRAMs send the data through a parallel port connection to the PC and histograms of raw data are displayed in the monitor using the SenseIt software. A block diagram of the XRD9827REF is shown below in Figure 1.

EXAR *... the analog plus compa*

EXAR Corporation 48720 Kato Road, Fremont, CA 94538 Phone (510)-668-7000, Fax (510)-668-7030

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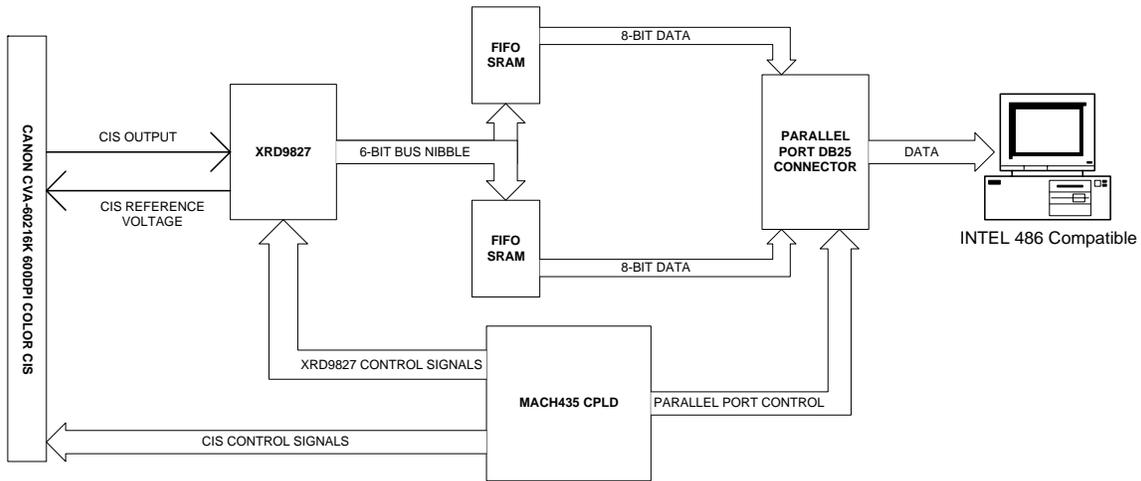
Figure 1. Block Diagram of XRD9827REF

The XRD9827 is a complete linear CIS or CCD sensor signal processor on a single monolithic chip. The
XRD9827 includes a high speed 12-Bit ADC, a 6-Bit Programmable Gain Amplifier with gain adjustment
of 1 to 10 and an 8-Bit programmable input referred offset calibration range of 800 mV. The XRD9827
also provides the necessary biasing voltage for the CANON CIS, eliminating the use of external
components (two diodes and two resistors). See the XRD9827EVAL User Manual / PCB board for
evaluating the XRD9827 CIS / CCD signal processor chip. A simplified functional block diagram of
XRD9827 is shown below for your reference.

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Figure 2. Simplified Functional Block Diagram of XRD9827

OPERATIONAL PROCEDURE

The routine listed below will first calibrate the photo response of the CIS using the XRD9827 by optimize its offset and gain. After calibration, the XRD9827REF can be used to scan any color target to show CIS non-color corrected response. (Color correction is typically done in the digital ASIC.)

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PRELIMINARY
How to Run the XRD9827REF Demonstration

1. Make sure the computer is powered off and the AC power adapter is disconnected from a wall outlet
2. Connect the parallel port cable to the printer port of the computer
3. Connect the AC power adapter into a wall outlet
4. Turn on the computer and activate Windows 95

Loading EXAR Software

5. Load the diskette labeled SenseIt 1.0 Disk # 1 into the floppy drive
6. Select the Start menu in the program manager and choose RUN
7. Inside the small pop-up window, type: A:\setup
8. Follow the instructions to finish software installation

Parallel Port Configurations

9. Confirm the parallel port address as follows:
    - I.   Select the Start Menu, choose Settings, then choose Control Panel
    - II.   From the Control Panel window which pops up, double-click on System
    - III.   In the System Properties window, select Device Manager
    - IV.   From the Device Manager window, double-click on Ports (COM & LPT)
    - V.   Double-click on Printer Port (LPT1). If you can not find it, please goto Step 10
    - VI.   From the pop-up window, select Resources
    - VII.   Verify the Input/Output Range is set to 0378 - 037F
    - VIII.   If the range is not correct, clear the Use Automatic Settings check box by clicking it
    - IX.   Choose correct address which is 0378 by default and click OK
    - X.   Re-start the computer as advised

10. If you do not have a Printer Port configured on your computer, please follow the steps listed below:
    - I.   From the Control Panel window which pops up, double-click on Add New Hardware
    - II.   From the pop-up window, click the Next > button
    - III.   Select 'No' when prompted for 'Do you want Windows to search for your new hardware?', then click the Next > button
    - IV.   Choose Ports (COM & LPT), then click the Next > button
    - V.   Choose Printer Port, then click the Next > button
    - VI.   Make a note of the Input/Output Range of Printer Port of your computer and click OK. You will use these values later when configure the SenseIt software
    - VII.   Re-start the computer as advised

Offset Adjustment With a Black Target

11. Set the dip switches located on the side panel of the scanner to [110 01000000] as shown in Figure 3 and push the Serial Port button which is located on the front panel of the demo system. This will reset the XRD9827.

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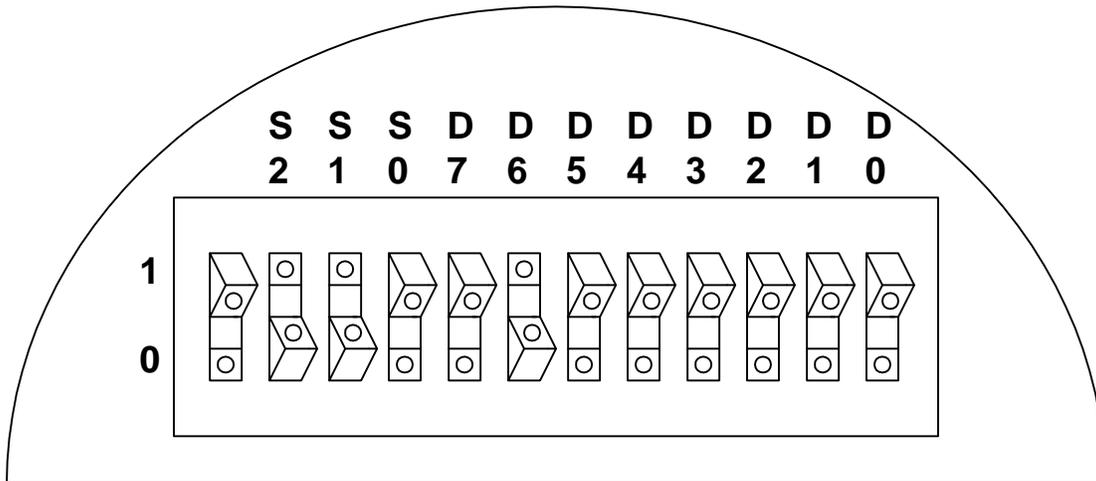
Figure 3. Dip Switches Set to Value [110 01000000] to Reset XRD9827

12. Select the Start Menu, choose Programs, then choose SenseIt icon

13. A window will pop up as shown below. The upper window shows the plot of captured data and the lower window shows the histogram of data. Figure 4 shows the pop-up window when SenseIt is first started.

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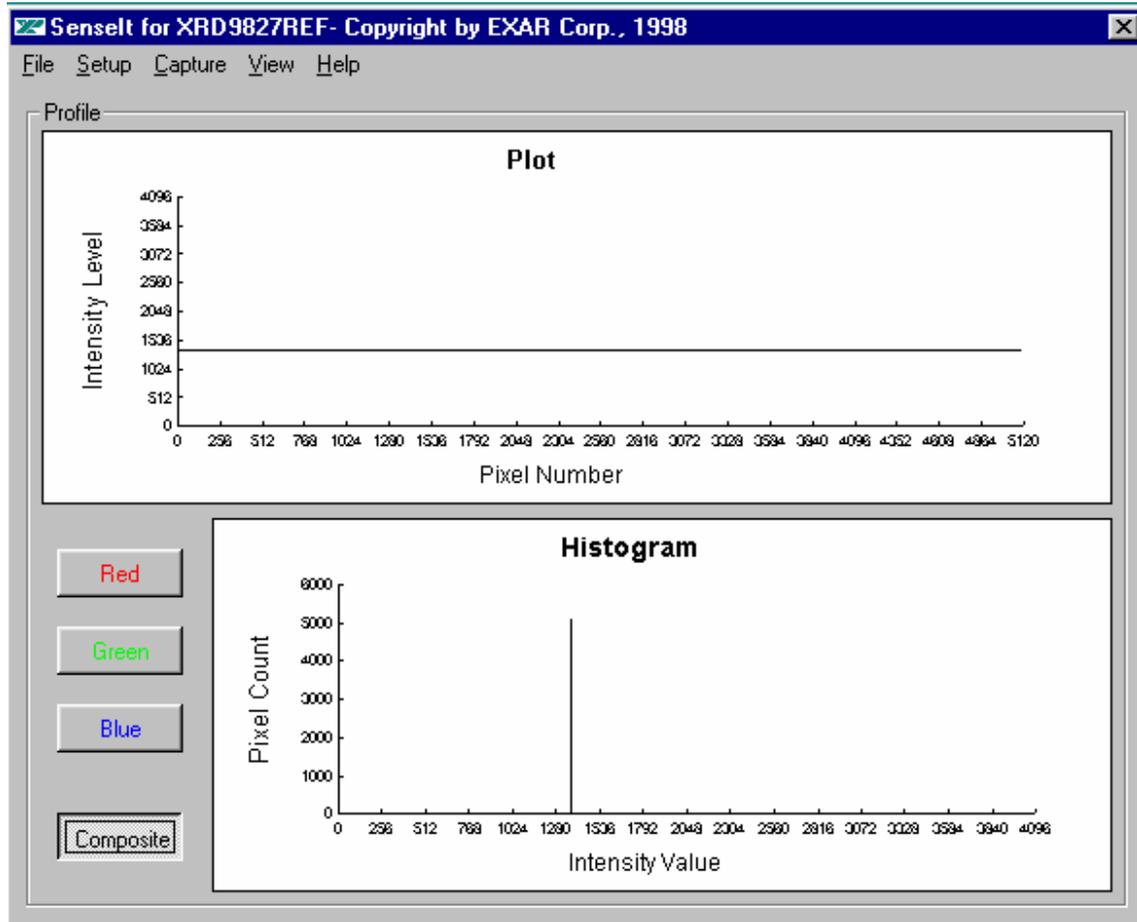
Figure 4. SenseIt Software Window Before Scanning

14. Select SETUP from the pull-down menu and choose I/O ADDRESS. In the window that pops up, type in the Input/Output Range of Printer Port of your computer. The default setting is 378H.

15. Pick the black target out from the kit and put it on a flat area. Place the XRD9827REF on top of the black target with the CIS sensor facing downwards. From the CAPTURE menu select SNAP SHOT (or simply press CTRL and B buttons simultaneously) for a single line scan of the black target with the dip switches set to [000 00000000]. A typical result of a black target scan is shown below:

PRELIMINARY
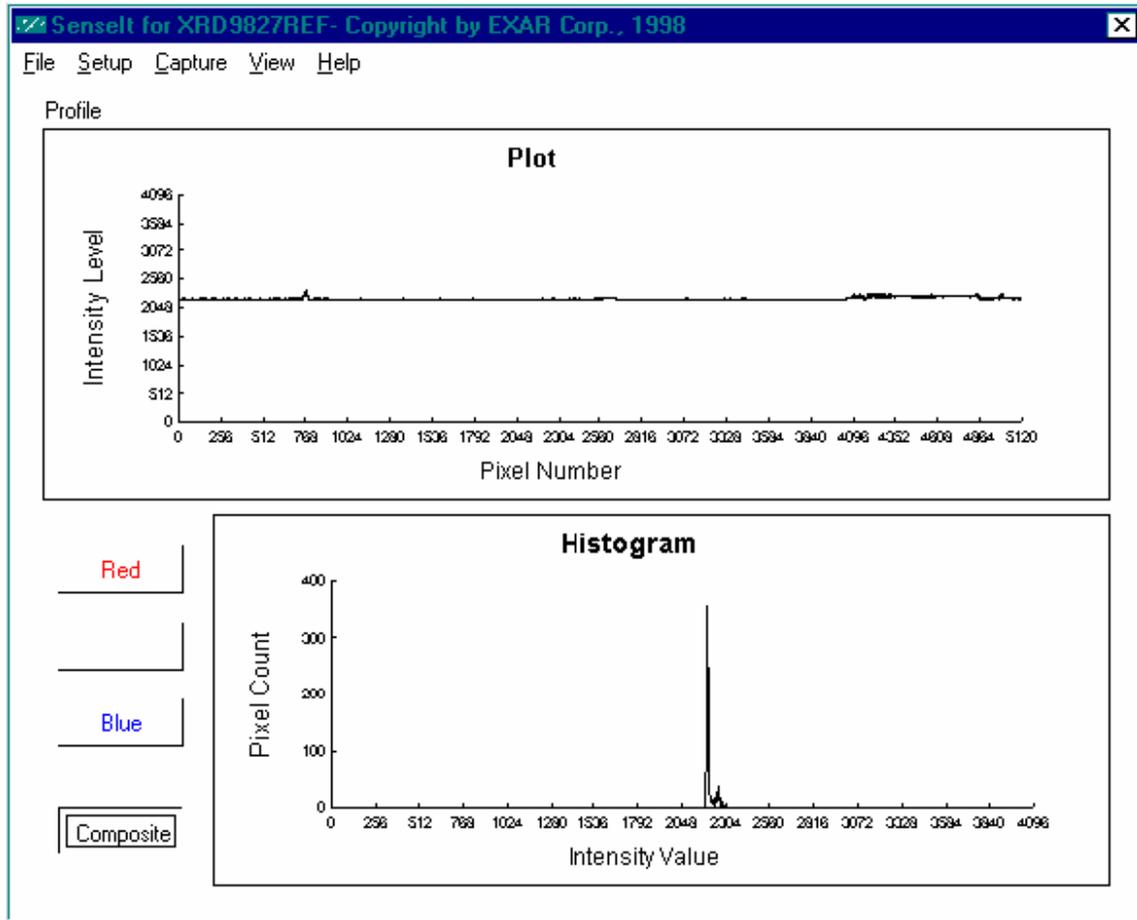
Figure 5. Non-calibrated Black Target Scan

16. Set the dip switches to [110 00010000] to tie VDCREF and VDCEXT pin together internally. Push the Serial Port button. The XRD9827 will subtract whatever voltage appears on VDCEXT (pin 16) from the input and thus perform a global offset adjustment. A typical result of the global offset adjustment is shown below. Please notice that the black code value has moved down.

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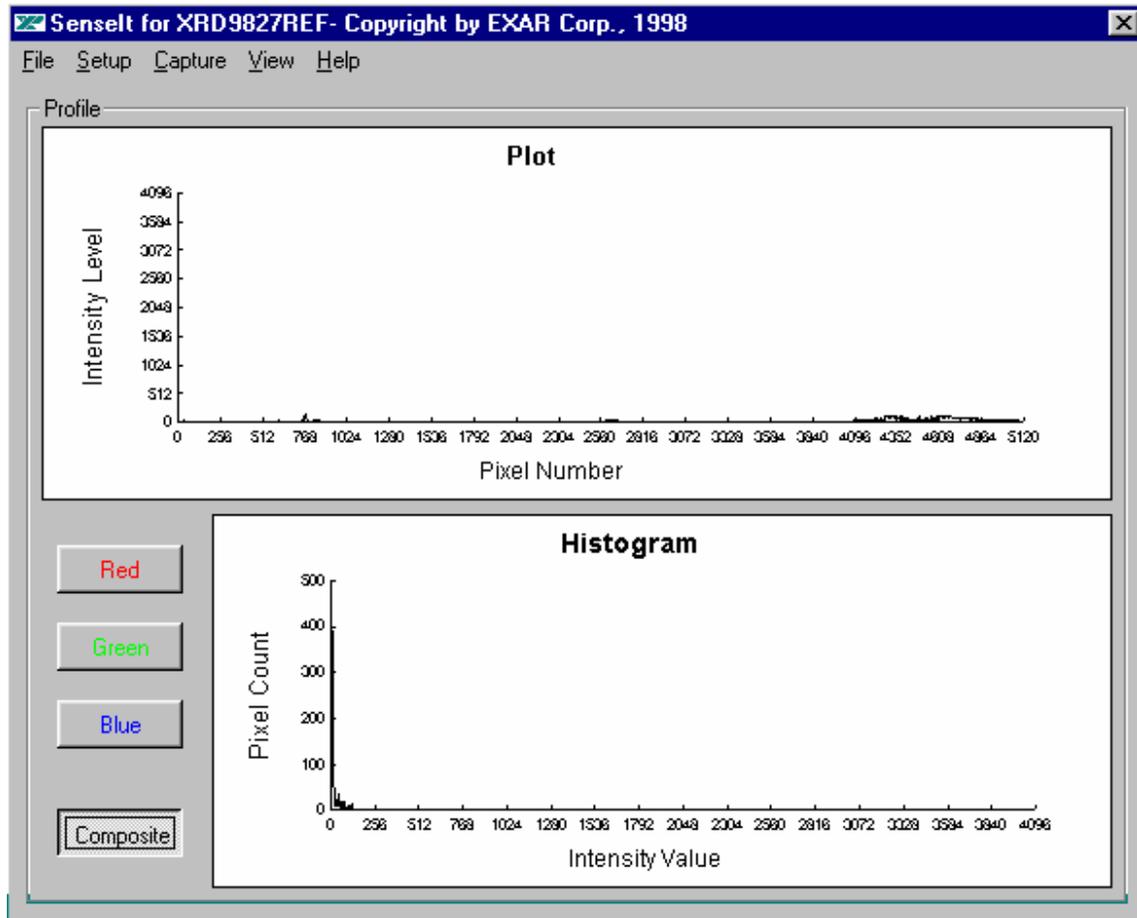
Figure 6. Black Target Scan After Global Offset Adjust Using the 9827 Internal Bandgap Reference Voltage

17. Then, set the dip switches to [111 00010000] and push the Serial Port button again. By doing this, a 1.24V reference voltage provided by an internal bandgap is applied to the VDCEXT pin. VDCEXT is connected to VREF pin (Pin 5) of the CANON CIS, this voltage is used by the CIS as a biasing voltage. Moreover, a 12K built-in resistor of the XRD9827 serves as a pull-down for the output of the CIS. By interfacing the XRD9827 with a CANON CIS, a designer can save two biasing diodes and two resistors and thus reduce cost.

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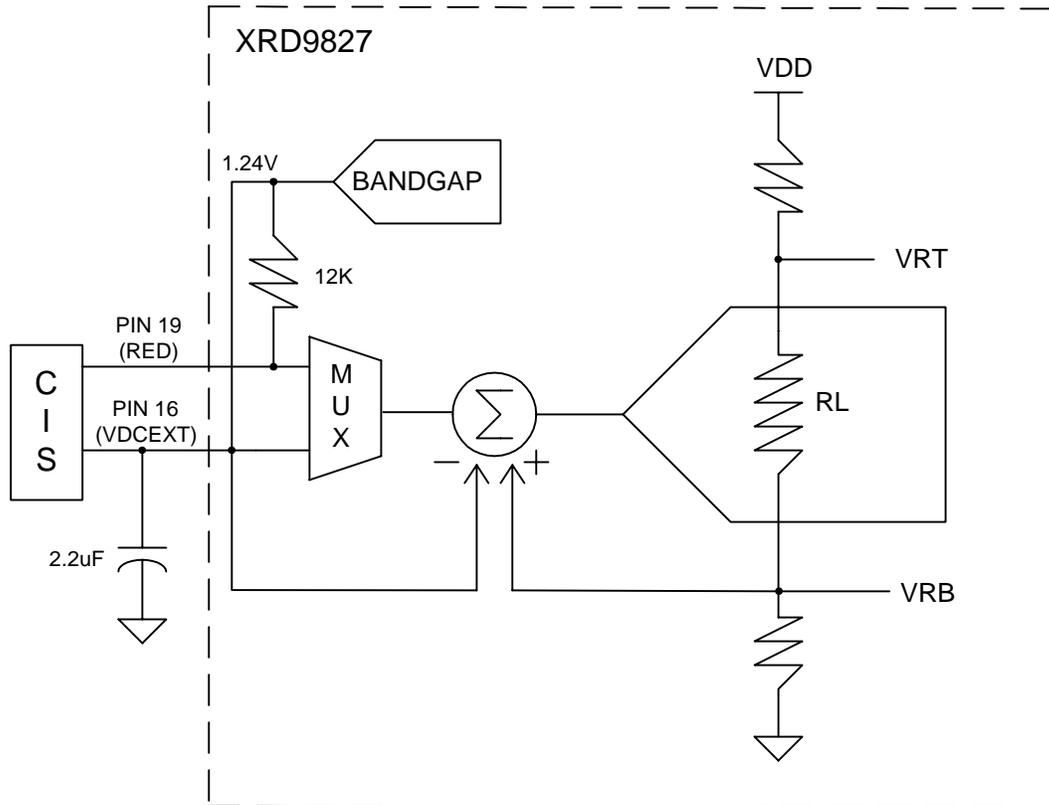
Figure 7. Simplified Block Diagram Showing Global Offset Adjustment by XRD9827 Using Internal Bandgap and CIS Using VDCEXT for Biasing

18. Set the dip switches to [001 01010000] to select the internal offset DAC for fine offset adjustment. Push the Serial Port button. From the CAPTURE menu select SNAP SHOT. The offset should now move the output of the CIS to almost zero scale. The other way to do a SNAP SHOT is by pressing CTRL and B button at the same time. Please refer to data sheet for offset adjustment. A typical result of the fine offset adjustment is shown below.
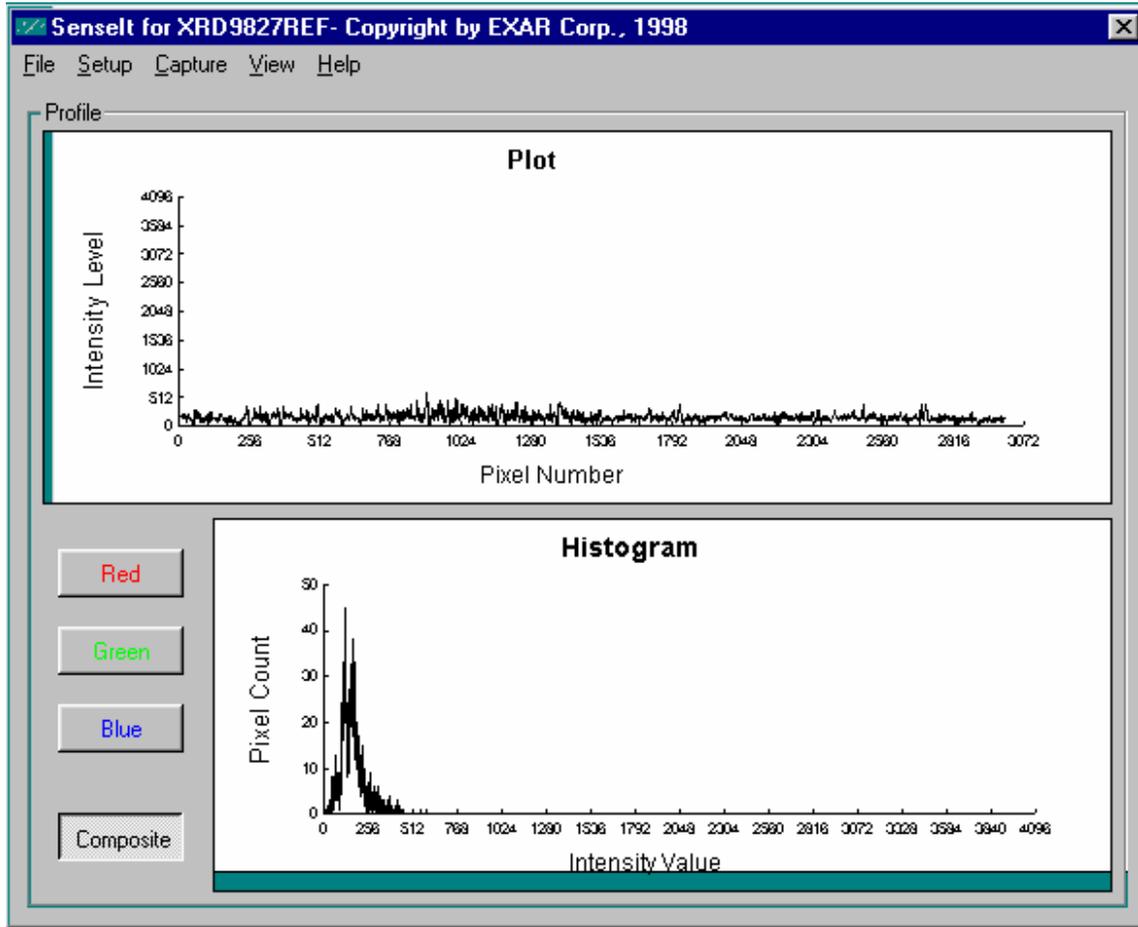
PRELIMINARY

Figure 8. Black Target Scan After Global and Fine Adjustment

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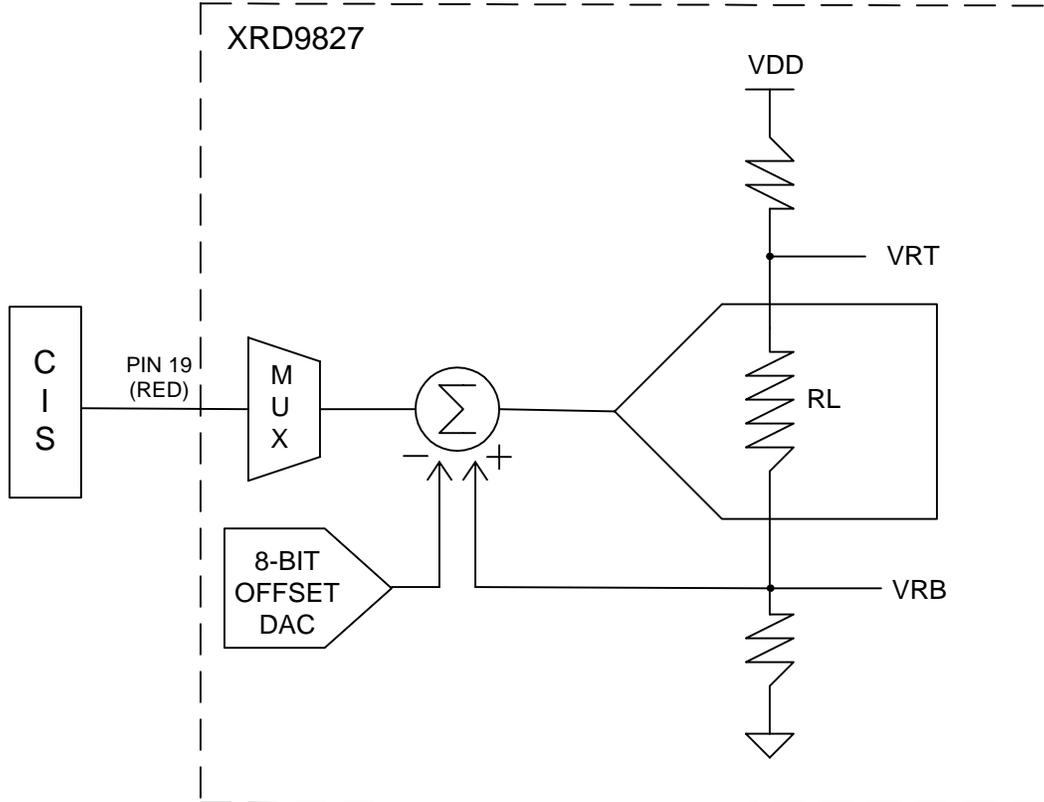
Figure 9. Simplified Block Diagram Showing Fine Offset Adjustment by XRD9827

19. Switch the black target to the enclosed white target. From the CAPTURE menu select SNAP SHOT for a single line scan of the white target. A typical result of a white target is shown below.

PRELIMINARY
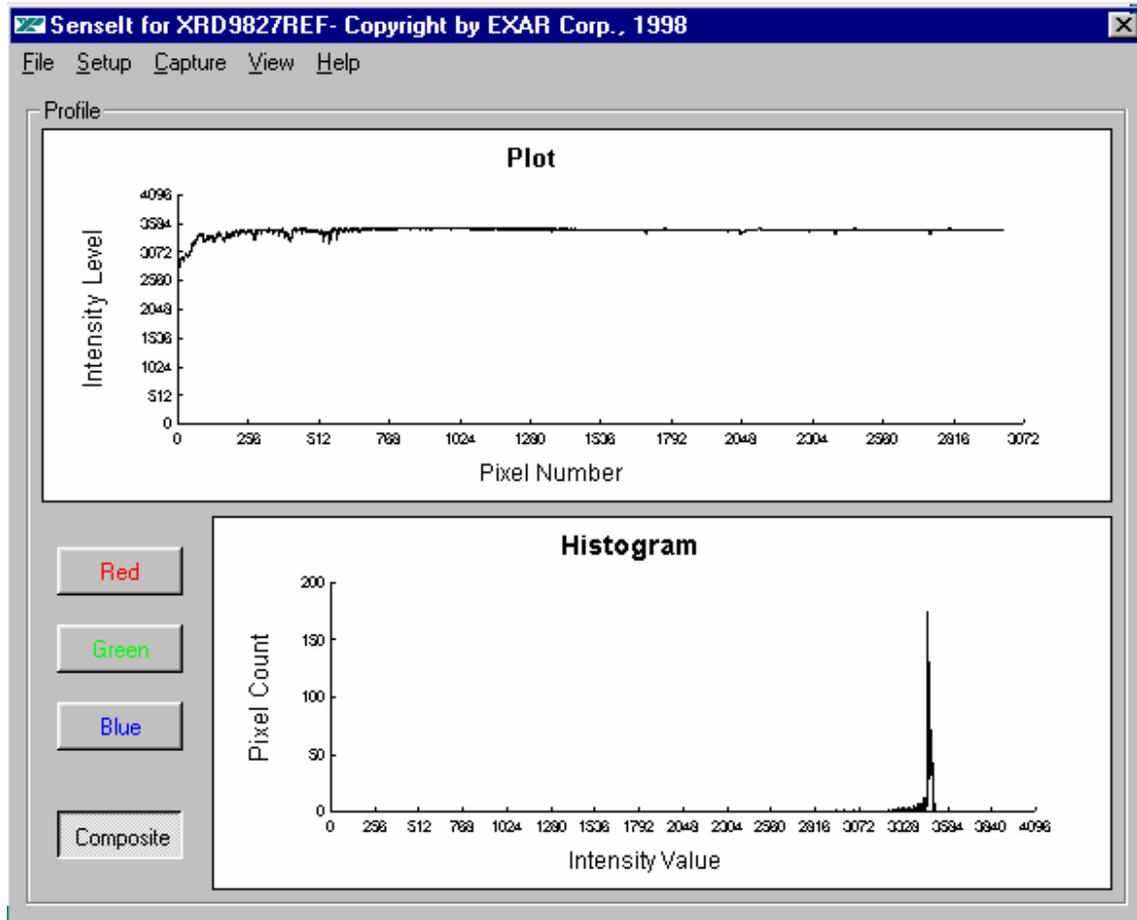
Figure 10. White Target Scan Without Gain Adjustment

20. Set the dip switches to [000 00001000] to select the desired gain. Push the Serial Port button. From the CAPTURE menu select SNAP SHOT. The gain should move the output of the CIS to almost full scale. Please refer to data sheet for further gain adjustment and optimal values of dip switches for your scanner. A typical result of the white target with gain adjustment is shown below.
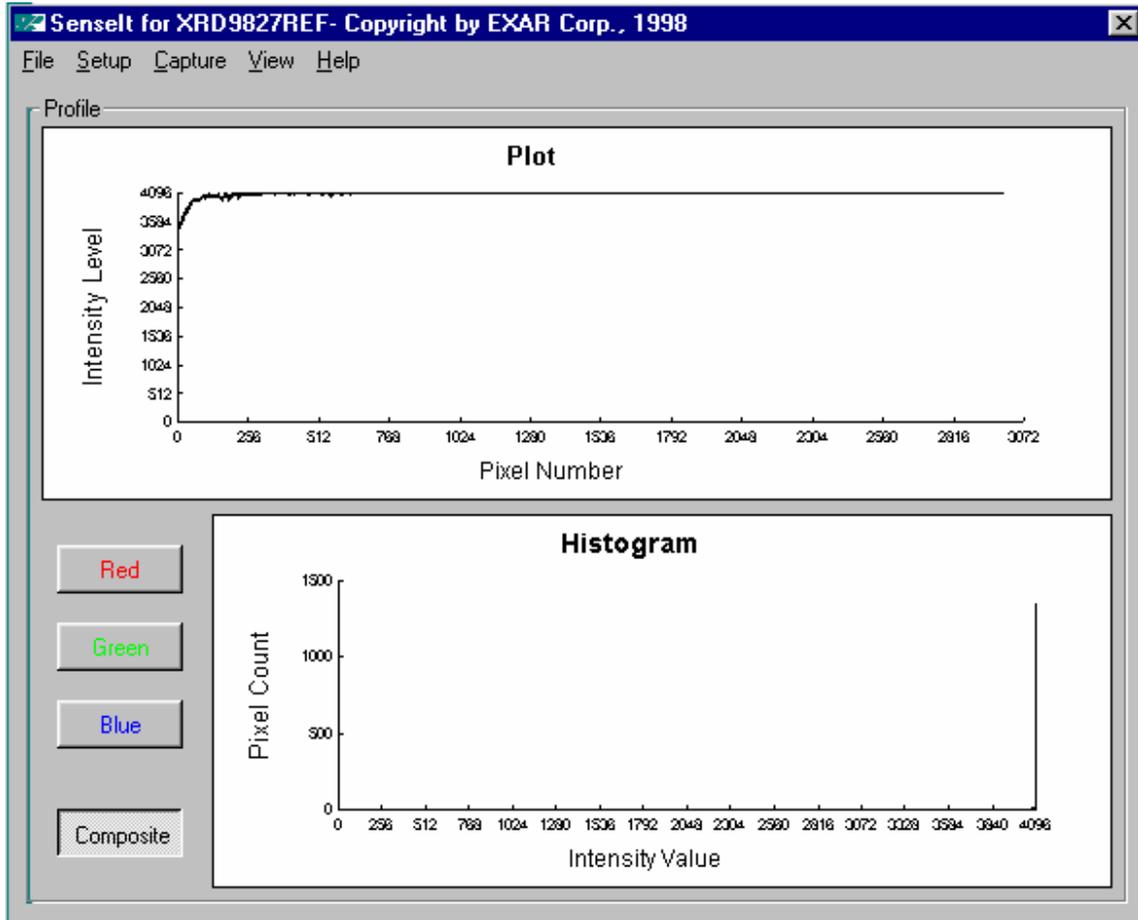
PRELIMINARY

Figure 11. White Target Scan After Gain Adjustment

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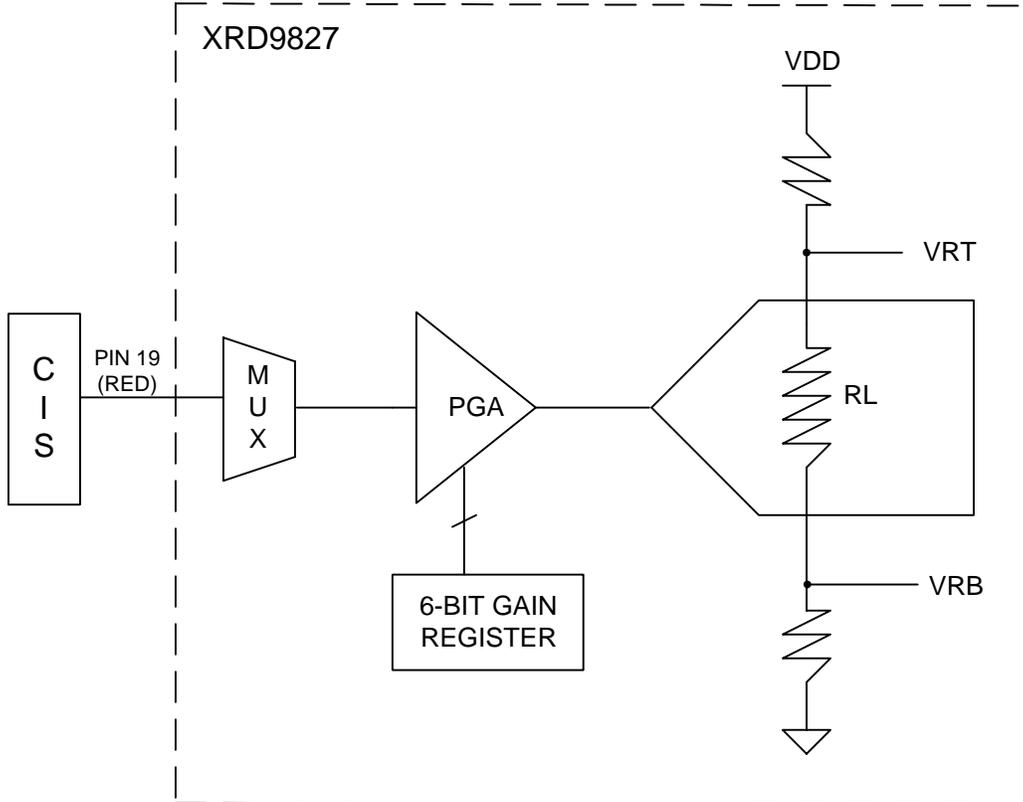
Figure 12. Simplified Block Diagram Showing Gain Adjustment by XRD9827

21. Once the XRD9827 has been fully calibrated, any target can be scanned. For example: Scan a gray scale to demonstrate the stair step response or a color target for color responsivity.

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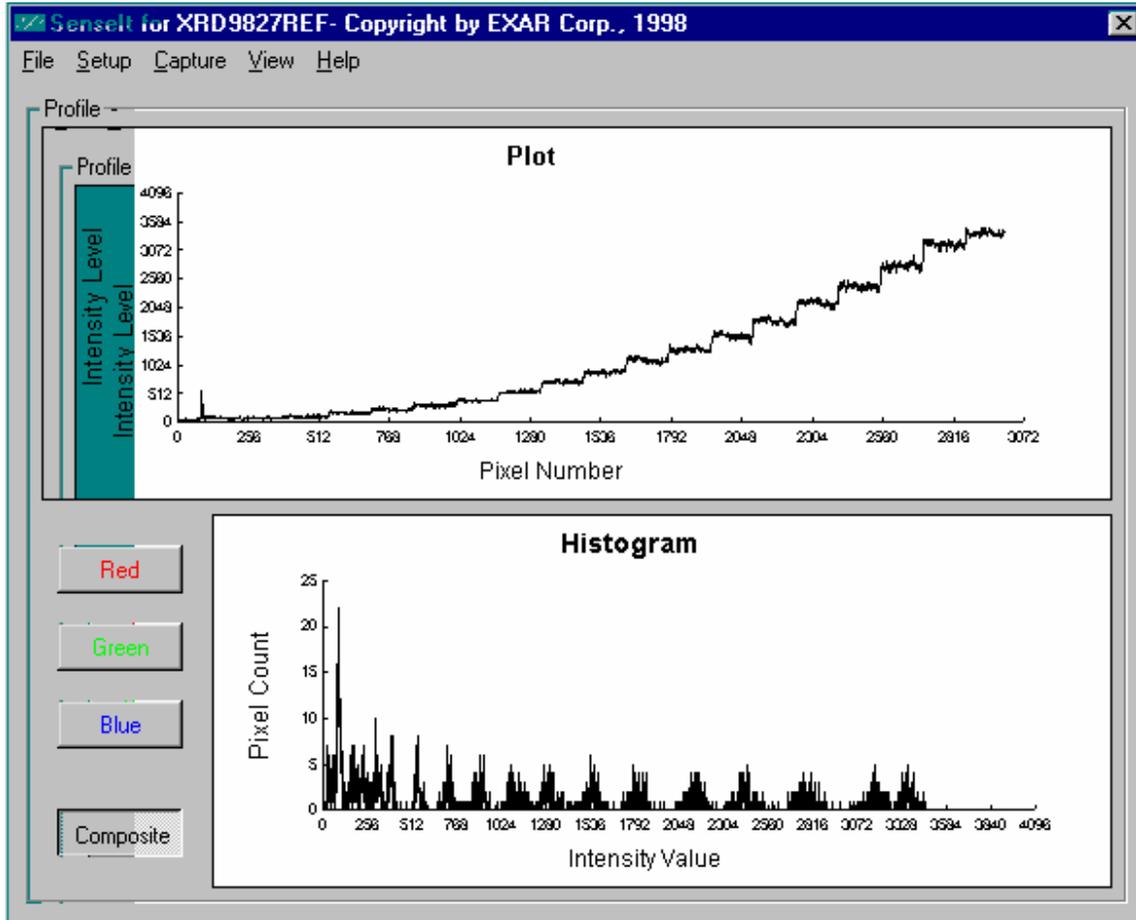
Figure 13. Gray-scale Target Scan

22. To demonstrate the noise component is contributed from the CIS, we hooked up a DC reference to the scanner and the results are shown below in Table 1.

REFERENCE DC (V)	STANDARD DEVIATION	SYSTEM SNR (dB) W/O CIS NOISE COMPONENT
2.0	2.144328	62.6117
2.5	3.48261	58.3988
3.0	2.399188	61.6356
3.5	1.983461	63.28842

Table 1. Signal-to-Noise Ratio of the XRD9827REF with DC Source as Input (No CIS Noise Component)

As we can see from Table 1, the SNR falls into the range of 58 dB to 63 dB when a DC reference is used as input to the XRD9827REF. The system alone gives a 9 1/2 to 10 bit performance. The largest noise source we saw in previous scans came from the CIS. A typical plot of the DC reference is shown in Figure 14.

PRELIMINARY
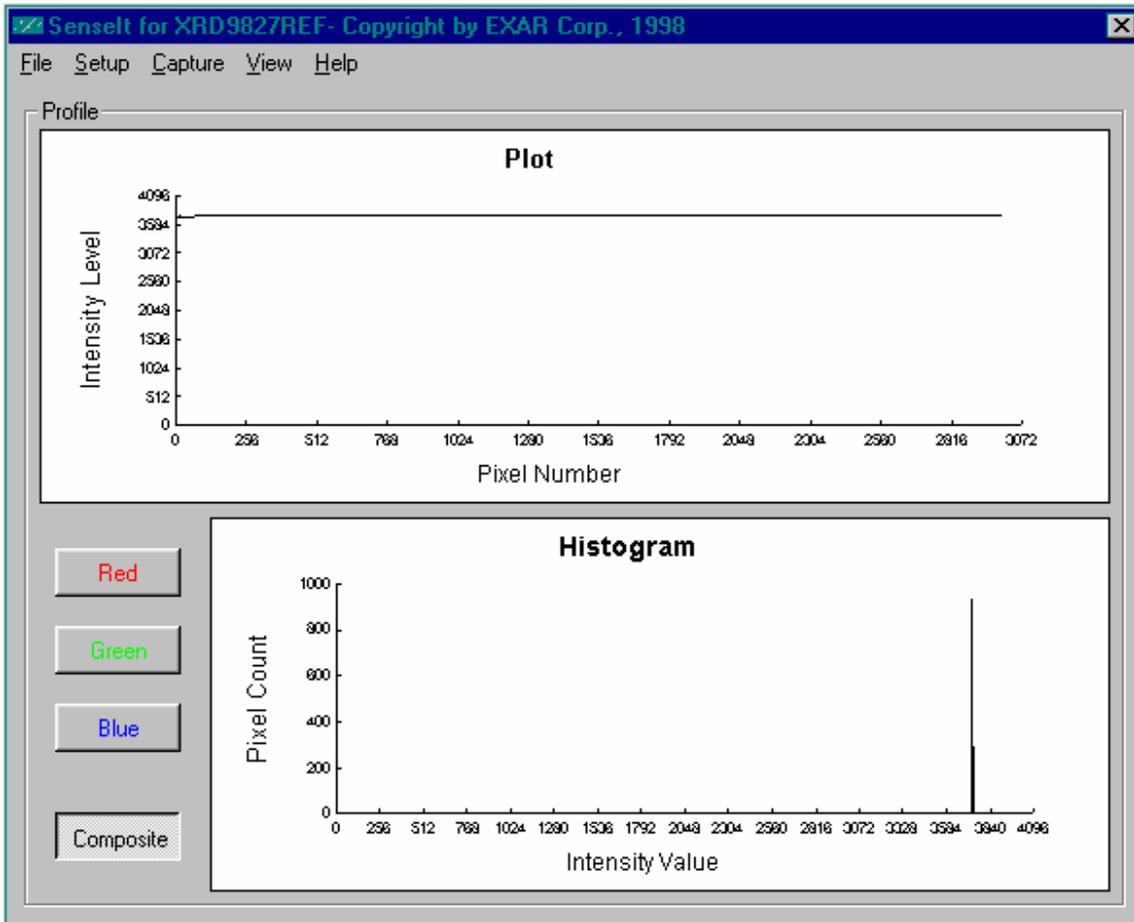
Figure 14. Plot of 3.5V DC Source as Input to the XRD9827REF

Important:

1.   If at any time an unexpected result is shown or the demo system seems to not working, please pull the AC adapter out from the wall outlet to cycle power. Start the procedures again from Step 11.

2.   Keep the scanner away from other electrical equipment, power cords, light dimmers, etc., as stray electrical fields can end up in the digitized data.

3.   Switch off all unnesscessary light sources and place the scanner flat on the image, this can prevent stray light from entering the sensor and disrupt the scan.

PRELIMINARY

XRD9827

POWER SUPPLY CIRCUITS

GO TO LED ON THE CASE OF SCANNER
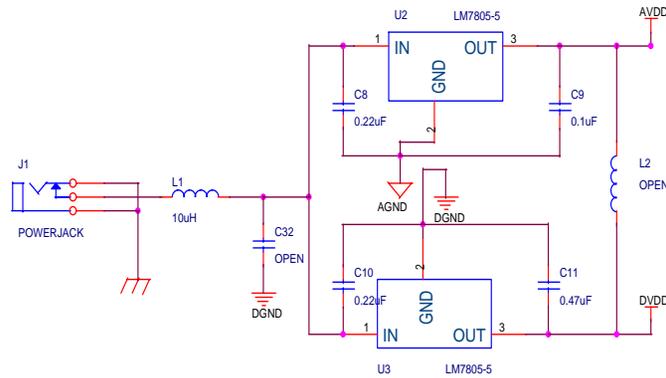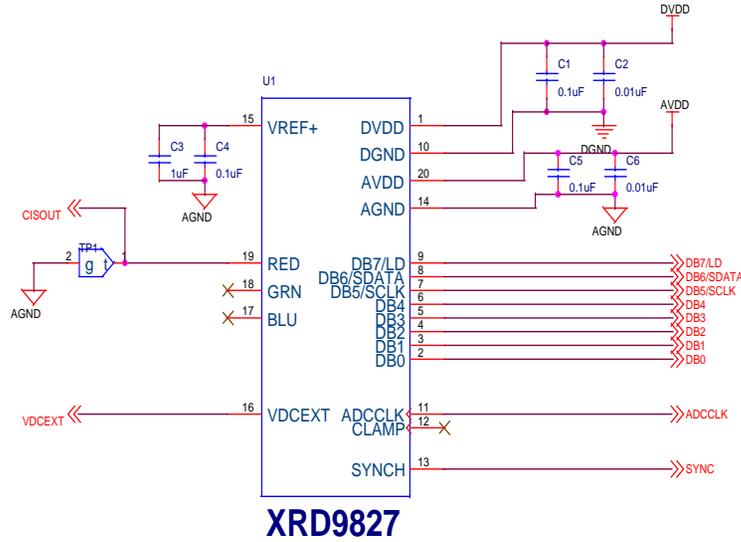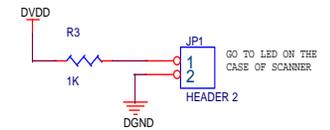
H:\PROJECT\ORCADWIN\9827\9827REFB.DSN

Title		
	XRD9827 REFERENCE BOARD	
Size B	Document Number XRD9827REF	Rev B
Date: Thursday, July 23, 1998	Sheet 1 of 3	

PRELIMINARY

DVDD

U4
MACH435

MACH435

DVDD6 DVDD5 DVDD4 DVDD3 DVDD2 DVDD1
84 83 44 42 21 2

SYNC — 82 IO63
WCLK2 — R4 33 — 81 IO62
80 IO61
79 IO60
78 IO59
77 IO58
76 IO57
75 IO56
73 IO55
72 IO54
71 IO53
70 IO52
69 IO51
RCLK — R19 33 — 68 IO50
ACK — 67 IO49
RST — R20 33 — 66 IO48
65 CLK3
62 CLK2
D7 — 61 IO47
WCLK1 — R21 33 — 60 IO46
59 IO45
58 IO44
57 IO43
D3 — 56 IO42
55 IO41
S1 — 54 IO40
52 IO39
51 IO38
50 IO37
SP_PB — 49 IO36
48 IO35
D6 — 47 IO34
S0 — 46 IO33
ADCCLK — R23 33 — 45 IO32
41 I1

I2 — 83
IO0 — 3 R5 33 — DB5/SCLK
IO1 — 4 R6 33 — DB6/SDATA
IO2 — 5 R7 33 — DB7/LD
IO3 — 6 STROBE
IO4 — 7
IO5 — 8 S2
IO6 — 9 AUTOFD
IO7 — 10
IO8 — 12
IO9 — 13
IO10 — 14
IO11 — 15 D5
IO12 — 16 D1
IO13 — 17 D4
IO14 — 18 D2
IO15 — 19 D0
CLK0 — 20
CLK1 — 23
IO16 — 24 SP
IO17 — 25
IO18 — 26 WEN
IO19 — 27
IO20 — 28
IO21 — 29
IO22 — 30
IO23 — 31
IO24 — 33 R22 33 — CISCLK
IO25 — 34
IO26 — 35
IO27 — 36 BLED
IO28 — 37
IO29 — 38 RLED
IO30 — 39 GLED
IO31 — 40

DGND8 DGND7 DGND6 DGND5 DGND4 DGND3 DGND2 DGND1
74 64 53 43 32 22 11 1

DGND

S1
1 24
2 23 S2 R8 2.2K
3 22 S1 R9 2.2K
4 21 S0 R10 2.2K
5 20 D7 R11 2.2K
6 19 D6 R12 2.2K
7 18 D5 R13 2.2K
8 17 D4 R14 2.2K
9 16 D3 R15 2.2K
10 15 D2 R16 2.2K
11 14 D1 R17 2.2K
12 13 D0 R18 2.2K
SW DIP-12
DGND

DVDD

DVDD
C14 C15 C16 C17 C18 C19 C20
10uF 0.1uF 0.1uF 0.01uF 0.01uF 0.01uF 0.01uF
DGND

JP2
1
2
3
HEADER 3 DGND

DVDD

U5 Oscillator
4 V+   NC 1
3 OUT GND 2
C12 C13
1uF 0.1uF
DGND

PRELIMINARY

U6

D8	DVDD
D7	RS*
D6	WEN1*
D5	WCLK
D4	WEN2*
D3	
D2	
D1	
D0	LSB

DVDD

WCLK2

Q8 / Q7 / Q6 / Q5 / Q4 / Q3 / Q2 / Q1 / Q0

PAF* / PAE* / REN1* / RCLK / REN2* / OE*

EF* / FF* GND

CY7C4261

DB0
DB1
DB2
DB3
DB4
DB5/SCLK
DB6/SDATA
DB7/LD

STROBE

J2

STROBE / AUTOFD

Q0 / Q1 / Q2 / Q3 / Q4 / Q5 / Q6 / Q7

INIT

DB25

U7A
74HC04

AUTOFD

RCLK

U8

D8	DVDD
D7	RS*
D6	WEN1*
D5	WCLK
D4	WEN2*
D3	
D2	
D1	
D0	MSB

RST
WEN
WCLK1

DVDD

Q8 / Q7 / Q6 / Q5 / Q4 / Q3 / Q2 / Q1 / Q0

PAF* / PAE* / REN1* / RCLK / REN2* / OE*

EF* / FF* GND

CY7C4261

ACK

Q[7..0]

C21 0.1uF   C22 0.1uF

DGND

DVDD

AVDD

C23 10uF   C24 1uF   C25 0.1uF   C26 0.01uF   C27 0.01uF

AGND

CISOUT
VDCEXT

U7B R24 300 SPN

JP3
JUMPER

R25 OPEN

SP
CISCLK
RLED
GLED
BLED

U7C R26 300 CISCLKN

R27 OPEN

JP4
HEADER 12 TO CIS

CISOUT
MODE
GND (ANALOG)
VCC
VREF
SP
CISCLK
LED ANODE
BLED
GLED
RLED
GND (FRAME)

U7D R28 10K BGND Q1 NPN_TO18

R33 100
R32 100
R34 100

U7E R29 10K GGND Q2 NPN_TO18

C28 100uF   C29 0.1uF   C30 47uF   C33 47uF

DVDD

U7F R30 10K RGND Q3 NPN_TO18

C31 0.1uF

74HC04

DGND   DGND   AGND

20